The ordinary manifestations of life cease at zero, but at -190° C. we have reason to suppose that intracellular metabolism must in addition practically cease—as a result of the withdrawal of two of its cardinal physical conditions, viz., heat and moisture. It is difficult to form a conception of living matter under this new condition, which is neither life nor death, or to select a term which will accurately describe it.

In previous experiments it was found that the photogenic bacteria preserved their normal luminous properties after exposure to the temperature of liquid air. On re-thawing, a rapid renewal of the photogenic properties of the cells occurred. The light is apparently produced by a chemical process of intracellular oxidation. The feasibility of triturating micro-organisms at the temperature of liquid air has now been experimentally established in the case of the typhoid bacillus and other bacteria.* The effect of such mechanical trituration at the temperature of liquid air on the luminous properties of the photogenic bacteria has now been tested. The experiments have shown that the effect of such a trituration is to abolish the luminosity of the cells in question.

This points to the luminosity being essentially a function of the living cell, and dependent for its production on the intact organisation of the cell.

I am indebted to Professor Dewar for valuable suggestions, and to Mr. Sydney Rowland and Mr. J. E. Barnard for their assistance in the experiments, which were carried out at the Jenner Institute of Preventive Medicine.

"An Intracellular Toxin of the Typhoid Bacillus." By Allan Macfadyen, M.D., and Sydney Rowland, M.A. Communicated by Lord Lister, F.R.S. Received August 14, 1902.

The existence of a specific toxin produced by the typhoid bacillus has hitherto not been demonstrated, although it has been assumed by analogy with other organisms and by reasoning from the clinical course of the disease.

Such a poison must either be intracellular or extracellular.

That it does not exist in filtered cultures of the organism is the common experience of bacteriologists. Its absence from such cultures might be due, however, to unsuitability of the soil used for growing the organism.

* "The Intracellular Constituents of the Typhoid Bacillus," Allan Macfadyen and Sydney Rowland, 'Centralblatt f. Bakteriologie,' vol. 30, 1901, No. 20.

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Accordingly the first step in the search for the body in question consisted in substituting for the usual broth and peptone media, culture fluids approaching more nearly in constitution the natural body soils which clinically support the growth of the bacillus. For this purpose, the organism was grown on the actual intracellular juices of the following organs and tissues obtained in a fresh condition from the ox or calf:—

Intestinal mucous membrane, mesenteric lymphatic glands and spleen. In each case the intracellular juice was brought to the requisite degree of alkalinity and used as a culture soil under the following conditions:—

1. Aerobically. 2. Anaerobically. 3. With addition of normal human serum. 4. After heating to 55° C. for 20 minutes.

After from 4 to 6 weeks' growth the organisms were filtered off and the filtrate tested for toxicity in guinea-pigs. With the possible exception of one spleen juice, none of the fluids thus obtained exhibited any acute toxic power. It thus became necessary to search within the typhoid organism itself for the missing toxin. For this purpose the organisms were grown on ordinary beef broth agar, and after careful washing with distilled water were disintegrated in a mechanical contrivance at the temperature of liquid air (– 180° C.) This course was taken to satisfy the conditions that—(1) No chemical change should take place during the disintegration, and (2) The organisms could be disintegrated alone, without the addition of any triturating substance, the necessary subsequent removal of which might vitiate the composition of the resulting mass. If such a disintegrated mass be freed from whole bacilli (if present) and from other suspended insoluble particles by centrifugalisation, an opalescent fluid results, which on inoculation into animals in small doses invariably proves toxic or fatal. It is therefore concluded that the typhoid bacillus contains within itself an intracellular toxin.

The typhoid cell juices obtained by the above method are being examined for immunising and other properties at the Jenner Institute of Preventive Medicine, where the above investigations have been conducted.